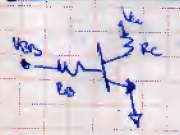
TE - Repaso

! En los ejercicios en polarización por divisor de tensión, DESPRECIAMOS la CORRIENTE DE BASE, para no es curo.



Q?

$V_{BB} = 5V$ $R_B = 100k$ $\beta = 300$ $Q(10'21V, 1'29mA)$

$V_{CC} = 12V$ $R_C = 1k$

$I_B = \frac{V_{BB} - V_{BE}}{R_B} = \frac{5 - 0'7}{100k} = 43\mu A$ $I_C = I_B \beta = 1'29mA$

$V_C = V_{CC} - I_C \cdot R_C = 12 - 1'29mA \cdot 1k = 10'71V$

Si $R_B = 100k$

$I_B = 43\mu A$ $I_C = 12'9mA$ $V_{CE} = 12V - 12'9mA \cdot 1k = -0'9V$ Saturado

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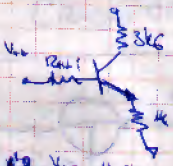
$R_1 = 10k$
$R_2 = 2k2$
$R_C = 3k6$
$R_E = 1k$
$\beta = 200$
$V_{CC} = 10V$

Q?



$V_{TH} = \frac{10 \cdot 2k2}{12k2} = 1'8V$

$R_{TH} = 1k8$

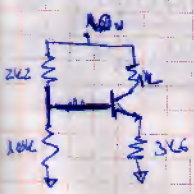
$I_B = \frac{1'8 - V_{BE} - 1k \cdot I_E}{1k8}$ $1k8 I_B = 1'8 - 0'7 - 1k \cdot 200 I_B$

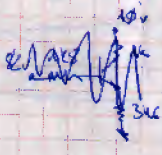
$I_B = \frac{1'1}{1M + 200k} = 5'45\mu A$ $I_E = 1'09mA$

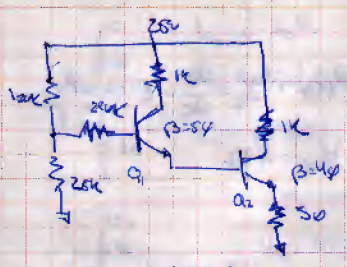
$V_{CE} = (10 - 3k6 \cdot 1'09mA) - (1k \cdot 1'09mA) = 4'98$

$I_{E_1} = I_{B_2} = I_{B_1} \beta_1$

$I_{E_2} = I_{B_1} \beta_1 \beta_2$







$I_{C_1} = 9\mu A \cdot 50 = 450\mu A$

$I_{C_2} = I_{E_2}$

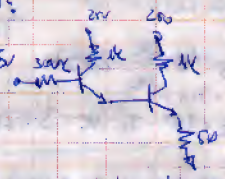
$V_{E_2} = 18mA \cdot 5\Omega = 0'9V$

$V_{B_1} = 0'9 + 0'7 = 1'6V$

$V_{C_2} = 25 - 18mA \cdot 1k = 7V$

$V_{C_1} = 25 - 450\mu A \cdot 1k = 24'55V$

Q?



$I_{E_2} \cdot 50 + 0'7 + 0'7 + I_{B_1} \cdot 300k = 5$

$50 \cdot 40 \cdot I_{B_1}$

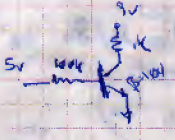
$(100k + 300k) I_{B_1} = 3'4$ $I_{B_1} = 9\mu A$

$I_{E_2} = 18mA$

$V_{CB_1} = 22'95$ $V_{CB_2} = 6'1V$

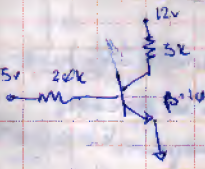
$Q_1 (22'5V, 450\mu A)$

$Q_2 (6'1V, 18mA)$



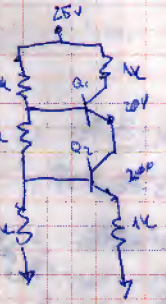
$I_C = \frac{5 - 0'7}{100k} = 43\mu A$ $V_C = 9V - 1k \cdot 43mA = 4'7V$

$Q (4'3mA, 4'7V)$



$I_B = \frac{5 - 0'7}{20k} = 215\mu A$ $I_C = 21'5mA$

$V_C = 12V - 21'5mA \cdot 5k = -95'5V$ → saturación!



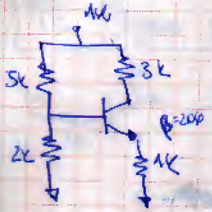
Q?

$V_{B_1} = 25 \cdot \frac{10k}{200k} = 12'5V$ $V_{E_1} = 11'8V = V_{C_2}$

$V_{B_2} = 25 \cdot \frac{5k}{200k} = 6'25V$ $I_{E_2} = \frac{5'55}{1k} = 5'55mA$

$V_{C_1} = 25 - 5'55mA \cdot 1k = 19'45$ $V_{CB_1} = 7'65V$ $V_{CB_2} = 6'25V$

$Q_1 (7'65, 5'55m)$ $Q_2 (6'25, 5'55m)$

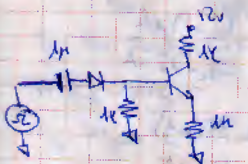


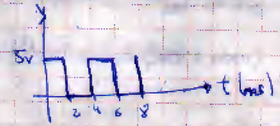
Q?

$V_B = 10 \frac{2k}{7k} = 2'857$ $V_E = 2'157$ $I_E = \frac{V_E}{1k} = 2'157mA$

$V_C = 10 - I_E \cdot 3k = 3'528$ $V_{CE} = 1'37$

Q (2'15mA, 1'37v)



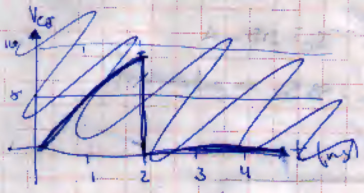


(t_0) $V_E = 4'3v$ $I_E = \frac{4'3v}{1k} = 4'3mA$ $V_C = 12 - 4'3mA \cdot 1k = 7'7v$ $V_{CE} = 3'4v$

(t_2) $V_C = V_f + (V_i - V_f) e^{-t/\tau} = 5 + (0-5) e^{-1ms/1ms} = 3'16v$

$V_B = 5 - 3'16 = 1'839$ $I_E = 1'839mA$ $V_C = 12 - 1'839 \cdot 1k = 10'16$ $V_{CE} = $ [illegible]

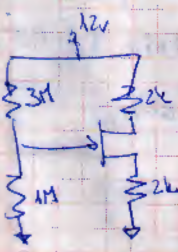
(t_{2+}) $V_C = 4'32v$ $V_B = 0'677v$ $V_E = -0'23$ corte $V_{CE} = 12v$



! Como en los periodos negativos el condensador no se descarga, el transistor siempre está en corte y $V_{CE} = 12v$.

(t_{2+}) $V_B = -4'32v$ → corte

(t_3) [illegible] → corte



$\beta = 1mA/v^2$ $V_G = 12 \frac{1M}{4M} = 3v$ $V_{GS} = 3v - 2k I_D$

$V_{GSoff} = -3v$ $I_D = \beta (V_{GS} - V_{GSoff})^2$ $I_D = 1 (3 - 2kI_D + 3)^2$

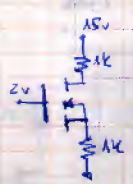
[illegible] $I_D = 6^2 + 4I_D^2 - 24 I_D$

$4I_D^2 - 25 I_D + 36 = 0$ $I_D <$ 2'25mA → $V_{GS} = -1'5v$; 4mA → $V_{GS} = -5$

$V_D = 12v - 2k \cdot 2'25mA = 7'5v$ $V_{DS} = 4'5v$

$V_{DS} = 7'5 - 2k \cdot 2'25mA = 3v$ ↳ > -(-3) activa V_{GSoff}

J (2'25mA, 3v)



$V_{GS} = 2 - I_D \cdot 1k$

$I_D = 1mA/v^2 (2 - I_D \cdot 1k - 1)^2$

$I_D = 1 + I_D^2 - 2I_D$

$I_D \begin{cases} 0'382\,mA \rightarrow V_{GS} = 1'618 \rightarrow ok! \text{ ON} \\ 2'618\,mA \rightarrow V_{GS} = -0'618 \end{cases}$

$V_D = 15 - 0'382mA \cdot 1k = 14'618$ $V_{DG} = 12'618$ Activa!

$V_{DS} = 14'618 - 0'382 =$ $V_{DS} > V_{GS} - V_{th}$

$V_{GS} = 5 - I_D \cdot 1k$

$I_D = 3mA/v^2 (5 - I_D 1k - 1v)^2$

$3I_D^2 - 25 I_D + 48 = 0$

$I_D \begin{cases} 3mA \rightarrow V_{GS} = 2v \rightarrow ok! \text{ ON} \\ 5'3mA \rightarrow V_{GS} = -0'3v \end{cases}$

$V_D = 10 - 3 = 7v$ $V_{DG} = 7 - 5 = 2v$ activa!

$V_{DS} = 7 - 3 = 4v$

¿? región? $V_{GS(off)} = -1v$ $\beta = 1mA/v^2$

$V_{GS} = 0 - 2I_D$

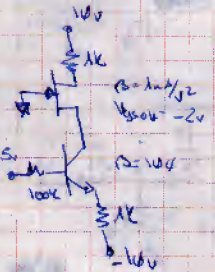
$I_D = (0 - 2I_D + 1)^2$

$4I_D^2 - 5I_D + 1 = 0$

$I_D \begin{cases} 0'25mA \rightarrow V_{GS} = -0'5v \rightarrow ok! \text{ ON} \\ 1mA \rightarrow V_{GS} = -2v \end{cases}$

$V_D = 15 - 0'5v = 14'5$ $V_{DG} = 14'5v > -(-1v)$ activa!

$V_{DS} = 14'5 - 0'5 = 14$ (14v, 0'5mA)



$I_B \cdot 100k = 5v + 0'7 + 100 I_B \cdot 1k + 10$

$5 - I_B 100k - 0'7 - 100 I_B 1k = 10$

$I_B \dfrac{14'3}{200k} = 0'0215mA$ $I_E = 2'145mA$

$I_D = I_E$ $V_D = 10 - 2'15 = 2'85v$

$2'1 = 1 (V_{GS} + 2)^2$

$2'1 = V_{GS}^2 + 4 + 4V_{GS}$ $V_{GS} \begin{cases} 0'665 \rightarrow ok! \text{ ON} \\ -4'665 \rightarrow \end{cases}$ $V_{DG} = 2'85 - 0 = 2'85 > 2$ activa!

$V_S = -0'665$ $V_{DS} = 2'85 + 0'665 = 3'51$

$V_C = V_S$ $V_{CE} = -0'665 - (2'15 - 10) = 2'185$

1'568

Calcular R_2 si sabemos $I_D = 2mA$

$\beta = 1mA/V^2 \quad V_{GSoff} = -2V$

$40 \pm \frac{\sqrt{1600 - 16\cdot 98}}{8}$

$40 \pm \frac{5'6568}{8}$

$V_{GS} = 0 - (R2 \cdot 2mA - 8v)$

$2 = 1(8 - R2\cdot 2 + 2)^2$

$2 = 100 + 4R2^2 - 40R2$

$4R_2^2 - 40R_2 + 98 = 0$

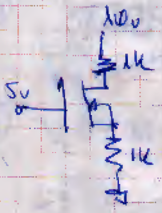
$R_2 <$ 4'29k → $V_{GS} = -0'58$ del ON ; 5'7k → $V_{GS} = -3'4$

~~$R_2 = 4'5k$ → … $V_{GS} = 4'29 - 8 = -3'71$~~

~~$R_2 = 5'7k$ → … $V_{GS} = 5'7 - 8 = -2'3$~~

$V_D = 8 - 2 = 6v \quad V_{DG} = 6v > +2v$ → activa

$V_{DS} = 5'42v$



$k = 6mA/V^2 \quad V_t = 1v \quad M?$

$V_{GS} = 5 - I_D \cdot 1k$

$I_D = 3(5 - I_D + 1)^2$

$I_D = 3I_D^2 + 48 - 24I_D$

$3I_D^2 - 25I_D + 48 = 0$

$I_D <$ 3mA → $V_{GS} = 2v$ del ON ; 5'3mA → $V_{GS} = -0'3v$

$V_{DG} = (10 - 3 = 7) - 5 = 2v > 1v$ activa

$V_{DS} = 7 - 3v = 4v$

$M(3mA, 4v)$

$V_t = -2v \quad k = 2mA/V^2 \quad V_I? \quad M?$

~~…~~

~~…~~

$V_{GS} = 0 - V_S$

$1 = 1(-V_S + 2)^2$ → $1 = V_S^2 + 4V_S + 4$ → $V_S <$ 1v → $V_{GS} = -1v$; 3v → $V_{GS} = -3v$ del ON

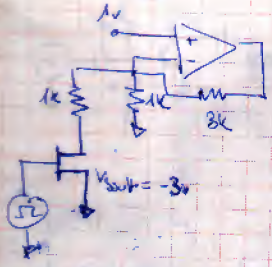
$V_D = -12v + 2k\cdot 1mA = -10v \quad V_{DG} = -10v < V_t$ → activa

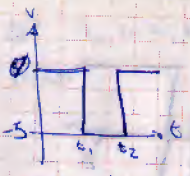
$V_{DS} = -10v - (-3v) = -7v \quad M(1mA, -7v)$

$V_I = 7v + 3v = 10v$

$10 = \frac{7}{2}\left(1 + \frac{y}{10k}\right)$

$9 \cdot 10k = y = 90k$

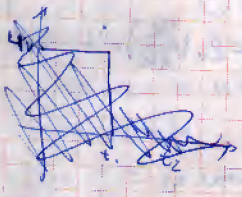


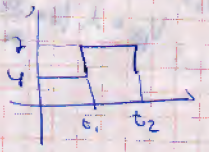


V_D?

↓ $V_{in} = 5V$ $V_{GS} = 5V$ → off

↓ $V_{in} = 0V$ $V_{GS} = 0V$ → ON



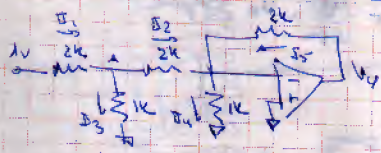


$1\left(1+\frac{3k}{1k}\right)$ $1\left(1+\frac{3k}{0'5k}\right)$

R_2 para $V_0 = 1V$?

$V_0 = -1\frac{10k}{1k} - 2V\frac{10k}{R_2}$

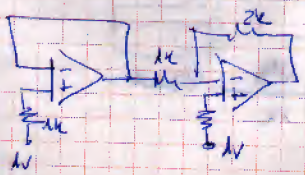
$-12 + 10 = -2V\frac{10k}{R_2}$ $R_2 = -2k\frac{10k}{-2V}$ $R_2 = 10k\Omega$



Calcular V_0 por corrientes.

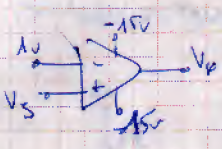
$\frac{1-V_A}{2k} = \frac{V_A-0}{2k} + \frac{V_A-0}{1k}$ $1-V_A = V_A + 2V_A$ $V_A = \frac{1}{4}$

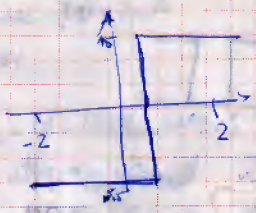
$\frac{1}{4} + V_0 = 0$ $V_0 = -\frac{1}{4}V$ $\frac{V_A-0}{2k} + \frac{V_0-0}{2k} = \frac{0-0}{1k}$

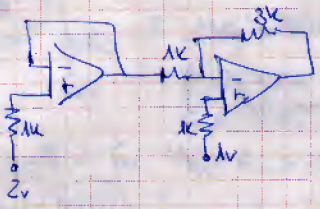


$V_0 = 1V\left(1+\frac{2k}{1k}\right) - 1V\left(\frac{2k}{1k}\right) = 1V$

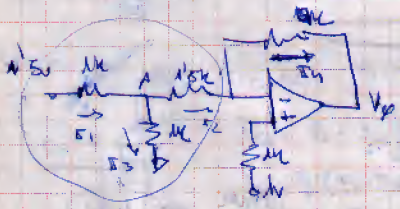
Vs [2, 8]



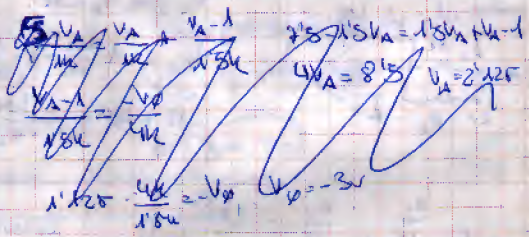




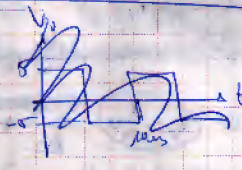
$V_\varphi = 1v\left(1+\frac{3k}{1k}\right) - 2v\left(\frac{3k}{1k}\right) = 4v - 6v = -2v$



$V_\varphi = 1\left(1+\frac{4k}{2k}\right) - 0'5\left(\frac{4k}{2k}\right) = 3 - 1 = 2v$

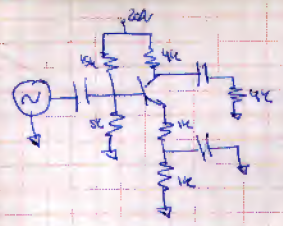


$A_v = \frac{3k \,||\, 4k}{100\Omega + \frac{25mV}{I_e = 4'3mA}} \simeq 16'2\varphi$



$R_e = (10k \,||\, 5k) \,||\, \left(100\Omega + \frac{25mV}{I_e = 4'3mA}\right) \simeq 10\varphi$

$V_B = 20\,\frac{5k}{20k} = 5v$ $\quad V_5 = 0'2 + I_e R_{e1} + I_e R_{e2}$ $\quad \frac{4'3}{1k} = 4'3mA$



Q? V_o si V_i 10mV?

$\beta = 100$

$V_B = 20V \cdot \frac{5k}{20k} = 5V$

$V_E = 5 - 0'7 = 4'3V$

$I_E = \frac{4'3V}{2k} = 2'15mA$

Q (7'14V, 2'15mA)

$V_C = 20 - 2'15mA \cdot 4k = 11'4V$

$V_{CE} = 11'4 - 4'3 = 7'1V$

$\frac{20}{20k} \rightarrow \frac{45mA}{100}$ · 20 correcto

$r_e = \frac{25mV}{2'15mA} = 11'16\Omega$

$Z_{base} = (R_c + r'_e)\beta = 11k + \frac{25mV}{2'15mA} \cdot 100 = 101'16k$

$Z_{entrada} = (R_1 \| R_2) \| 101'16k = 3'62k$

$A_V = \frac{-R_c}{R_e + r'_e} = \frac{-2k}{1'011k} = -1'977$

DSED - Reposo

K	Y	
0	0	A
0	1	B
1	0	C
1	1	D